signals in the pair having a quadrature phase relationship with the other of the digital signals in the pair,

third means for adjusting the phases of the digital signals in the pair to conform to the phases of the quadrature amplitude modulated signals in the coaxial cable, and

fourth means responsive to the signals from the third means for varying the rate of converting the analog signals to the digital signals to provide the digital signals at a rate having a particular relationship to the particular baud rate.

14. In a combination as set forth in claim 13,

the third means including means for derotating the digital signals in the pair.

15. In a combination as set forth in claim 13,

the third means including a feed forward equalizer and a decision feedback equalizer and a pair of slicers each operable on an individual one of the digital signals in the pair to slice the digital signals into the closest of a number of binary values.

16. In a combination as set forth in claim 15,

the third means including fifth means for derotating the digital signals in the pair,

the fourth means being responsive to the derotated

signals from the third means and to the digital signals from the slicers in the pair to lock the phases of the digital signals from the third means to the phases of the quadrature amplitude modulated signals in the coaxial cable.

17. In combination for operating upon analog signals transmitted through a coaxial cable using quadrature amplitude modulated data on a carrier signal of a particular frequency to recover the quadrature amplitude modulated data from noise and distortions in the coaxial cable,

first means for converting the intermediate frequency analog signals in the receiver to digital signals at a variable rate,

second means for operating upon the digital signals to provide a pair of the digital signals, one of the digital signals in the pair having a quadrature phase relationship with the other of the digital signals in the pair,

third means for adjusting the phases of the digital signals in the pair to conform to the phases of the quadrature amplitude modulated signals in the coaxial cable,

fourth means for providing an oscillator having a variable frequency, the fourth means being disposed before the first means in the combination, and

fifth means responsive to the digital signals from the third means for varying the frequency of the oscillator to obtain the production, from the mixing of the analog signals and the oscillator signals, of intermediate frequency signals

having a particular frequency.

18. In a combination as set forth in claim 17,

the third means including means for derotating the digital signals in the pair.

19. In a combination as set forth in claim 17,

the third means including a feed forward equalizer and a decision feedback equalizer and a pair of slicers each operable on an individual one of the digital signals in the pair to slice the digital signals into the closest of a number of binary values.

20. In a combination as set forth in claim 19,

the third means including fifth means for derotating the digital signals in the pair,

the fourth means being responsive to the derotated signals from the third means and to the digital signals from the slicers in the pair to lock the variable frequency of the oscillator to obtain the production, from the mixing of the analog signals and the oscillator signals, of intermediate frequency signals having a particular frequency.

21. In combination for operating upon analog signals transmitted through a coaxial cable using quadrature

amplitude modulated data at a particular baud rate to recover the quadrature amplitude modulated data from noise and distortions in the coaxial cable,

first means for converting the analog signals to digital signals at a variable rate,

second means for operating upon the digital signals to provide a pair of the digital signals, one of the digital signals in the pair having a quadrature phase relationship with the other of the digital signals in the pair,

third means for adjusting the phases of the digital signals in the pair to conform to the phases of the quadrature amplitude modulated signals in the coaxial cable,

fourth means responsive to the signals from the third means for providing a first closed loop servo with the third means for adjusting the operation of the first means to a rate having a particular relationship to the particular baud rate, and

fifth means responsive to the signals from the third means for providing a second closed loop servo with the third means for locking the phases of the pair of the digital signals from the third means to the phases of the quadrature amplitude modulated signals in the transmitter.

22. In a combination as set forth in claim 21,

the fourth means including a first digital-to-analog converter for converting the digital signals from the third means to corresponding analog signals for adjusting the

operation of the first means to a rate having the particular relationship to the particular baud rate, and

the fifth means including a second digital-to-analog converter for converting the digital signals from the third means to corresponding analog signals for locking the phases of the pair of the digital signals from the third means to the phases of the quadrature amplitude modulated signals in the coaxial cable.

23. In a combination as set forth in claim 21,

means responsive to the digital signals from the first means for regulating the amplitude of the digital signals.

24. In a combination as set forth in claim 21,

the quadrature amplitude modulated analog signals in the coaxial cable including carrier signals at a particular frequency, and

sixth means for providing signals having a variable frequency, and

seventh means responsive to the pair of the digital signals from the third means for varying the frequency of the signals from the sixth means to obtain, upon a mixture of the signals from the sixth means and the carrier signals, intermediate frequency signals having a particular frequency.

25. In combination for operating upon analog

signals transmitted through a coaxial cable using quadrature amplitude modulated data at a particular carrier frequency to recover the quadrature amplitude modulated data from noise and distortions in the coaxial cable,

first means for converting the analog signals to digital signals,

second means for operating upon the digital signals to provide a pair of the digital signals, one of the digital signals in the pair having a quadrature phase relationship with the other of the digital signals in the pair,

third means for adjusting the phases of the digital signals in the pair to conform to the phases of the quadrature amplitude modulated signals in the coaxial cable,

fourth means responsive to the signals from the third means for providing a first closed loop with the third means for locking the phases of the pair of the digital signals from the third means to the phases of the quadrature amplitude modulated signals in the coaxial cable,

fifth means for providing signals having a variable frequency, and

sixth means responsive to the signals from the third means for providing a second closed loop with the third means for varying the frequency of the signals from the fifth means to obtain, upon a mixture of the signals at the carrier frequency and the signals having the variable frequency, intermediate frequency signals having a particular frequency.

26. In a combination as set forth in claim 25,

the fourth means including a first digital-to-analog converter for converting the pair of the digital signals from the third means to corresponding analog signals for adjusting the operation of the third means to lock the phases of the pair of the digital signals from the third means to the phases of the quadrature amplitude modulated signals in the coaxial cable,

the sixth means including a second digital-to-analog converter for converting the digital signals from the third means to corresponding analog signals for locking the frequency of the signals from the fifth means relative to the carrier frequency for obtaining the intermediate frequency signals with a particular frequency.

27. In a combination as set forth in claim 25,

means responsive to the analog signals from the first means for regulating the amplitude of the analog signals.

28. In a combination as set forth in claim 25,

the third means including seventh means for derotating the digital signals in the pair and further including eighth means for equalizing the derotated digital signals in the pair from the seventh means.

29. In a combination as set forth in claim 26,

seventh means responsive to the analog signals from the first means for regulating the amplitude of the analog signals, and

the third means including eighth means for derotating the digital signals in the pair and further including ninth means for equalizing the derotated digital signals in the pair from the eighth means.

30. In combination for operating upon analog signals transmitted through a coaxial cable using quadrature amplitude modulated data to recover the quadrature amplitude modulated data from noise and distortions in the coaxial cable,

first means for converting the analog signals to digital signals,

second means for operating upon the digital signals to provide a pair of the digital signals, one of the digital signals in the pair having a quadrature phase relationship with the other of the digital signals in the pair, and

third means for adjusting the phases of the digital signals in the pair to conform to the phases of the quadrature amplitude modulated signals in the coaxial cable, the third means including a feed forward equalizer and a decision feedback equalizer, the decision feedback equalizer including a pair of slicers each operable on an individual one of the digital signals in the pair to slice the digital signals into the closest of a number of binary values, the number being

progressively increased with time.

31. In a combination as set forth in claim 30,

the decision feedback equalizer having an output connected to the feed forward equalizer to control the operation of the feed forward equalizer in accordance with the operation of the decision feedback equalizer.

32. In a combination as set forth in claim 31,

a second pair of slicers,

the third means including a pair of adders each operative to receive the output of the decision feedback equalizer and the output of the feed forward equalizer and each operative to introduce its output to an individual one of the slicers in the second pair.

33. In a combination as set forth in claim 32,

means responsive to the output from the third means for feeding the output back to the third means to facilitate the adjustment of the amplitudes and phases of the digital signals in the pair to conform to the amplitudes and phases of the quadrature amplitude modulated signals in the transmitter.

34. In combination for operating upon analog signals transmitted through a coaxial cable using quadrature amplitude modulated data to recover the quadrature amplitude modulated data from noise and distortion in the coaxial cable,

first means for converting the analog signals to corresponding digital signals,

second means for operating upon the digital signals to provide a pair of the digital signals, one of the digital signals in the pair having a quadrature phase relationship with the other of the digital signals in the pair,

third means for adjusting the phases of the digital signals in the pair to conform to the phases of the quadrature amplitude modulated signals in the coaxial cable,

the third means including fourth means for derotating the phases of the digital signals in the pair and including fifth means for providing a feed forward equalization of the derotated digital signals in the pair and including sixth means for providing a decision feedback equalization of the signals from the fifth means.

35. In a combination as set forth in claim 34,

means for feeding the signals from the sixth means back to the fifth means to enhance the feed forward equalization provided by the fifth means.

36. In a combination as set forth in claim 34,

the decision feedback equalizer including a pair of slicers each operable on an individual one of the digital signals in the pair to slice the digital signals into the closest of a number of binary values, the number being

progressively increased with time.

37. In a combination as set forth in claim 36,

a pair of adders each operatively coupled to the feed forward equalizer and the decision feedback equalizer to operate upon one of the digital signals in the pair, and

a pair of additional slicers each operatively coupled to an individual one of the adders in the pair to provide an output of one of the digital signals in the pair without the noise and distortion in the coaxial cable.

38. In combination for operating upon analog signals transmitted through a coaxial cable using quadrature amplitude modulated data to recover the quadrature amplitude modulated data from noise and distortion in the coaxial cable,

first means for converting the analog signals to corresponding digital signals,

second means for operating upon the digital signals to provide a pair of the digital signals, one of the digital signals in the pair having a quadrature phase relationship with the other of the digital signals in the pair,

third means for adjusting the phases of the digital signals in the pair to conform to the phases of the quadrature amplitude modulated signals in the coaxial cable,

the third means including fourth means for derotating the phases of the digital signals in the pair and

including fifth means for equalizing the derotated digital signals in the pair.

39. In a combination as set forth in claim 37,

means responsive to the derotated digital signals in the pair and to the equalized digital signals in the pair for operating upon the fourth means to facilitate the derotation of the digital signals in the pair by the fourth means.

40. In a combination as set forth in claim 37,

the quadrature amplitude modulated signals in the coaxial cable having a particular baud rate, and

means responsive to the derotated digital signals and to the equalized digital signals for operating upon the first means to obtain the conversion of the analog signals to the digital signals at a rate having a particular relationship to the particular baud rate.

41. In a combination as set forth in claim 37,

the signals in the coaxial cable including carrier signals with a particular carrier frequency, and

an oscillator having a variable frequency, and

means responsive to the derotated digital signals and the equalized digital signals for varying the frequency of the oscillator to provide, upon a mixing of the analog signals and the signals from the oscillator, intermediate frequency signals having a particular frequency.

42. In combination for operating upon analog signals transmitted through a coaxial cable using quadrature amplitude modulated data to recover the quadrature amplitude modulated data from noise and distortions in the coaxial cable,

first means for converting the analog signals to corresponding digital signals,

second means for operating upon the digital signals to provide a pair of the digital signals, one of the digital signals in the pair having a quadrature phase relationship with the other of the digital signals in the pair,

third means for adjusting the phases of the digital signals in the pair to conform to the phases of the quadrature amplitude modulated signals in the coaxial cable,

the third means a sequential arrangement of a derotator, a feed forward equalizer and a decision feedback equalizer.

43. In a combination as recited in claim 41,

means responsive initially to the outputs of the derotator and the decision feedback equalizer, and subsequently to signals from the decision feedback equalizer, for operating upon the derotator to facilitate the derotation of the phases of the digital signals in the pair.

44. In a combination as set forth in claim 41,

the quadrature amplitude modulated signals in the